

XIX. THE SYSTEMATIC STATUS AND BREEDING HABITS OF *EUPEMPHIX TRINITATIS* BOULENGER.

BY M. GRAHAM NETTING.

Many workers have studied the breeding habits of *Eupemphix pustulosus*, but to the best of my knowledge no observations on the related species, *E. trinitatis*, have ever been published. Undoubtedly the most detailed study of *E. pustulosus* is the one which Breder made in Panama, the salient features of which have been reported by Noble<sup>1</sup>. The following notes, admittedly incomplete, may be of interest since they indicate that these species, which are structurally much alike, have similar breeding habits.

My observations were made on the island of Trinidad during September 1927, and during short visits in October 1929 and February 1930. All of my specimens were taken in St. George County about ten miles from Port-of-Spain, collections being made both in the lowlands at St. Augustine at an elevation of approximately one hundred feet and at Mount St. Benedict in the northern mountain range at various altitudes up to nine hundred feet.

*Eupemphix trinitatis* was described by Boulenger<sup>2</sup> in 1889 on the basis of four specimens from Port-of-Spain. Ten years later Werner<sup>3</sup> described *Bufo atrigularis* from Trinidad. This name has been appropriately referred to the synonymy of *E. trinitatis*. Lutz in several recent papers has considered *E. trinitatis* a synonym of *E. pustulosus*. In this matter I am unable to agree with him for reasons which I have outlined below, and which I will consider in detail in a later paper. In order to determine the status of *E. trinitatis* I examined all of the specimens of *Eupemphix* from Mexico, Panama, Colombia, and Venezuela in the collection of the Museum of Zoölogy of the University of Michigan, all of the material from Venezuela and Trinidad in the collection of the Carnegie Museum, and four specimens from Trinidad in the collection of the United States National Museum. I studied thirty-three specimens from Trinidad, twenty-seven from

<sup>1</sup>Noble, G. K. 1927. Annals N. Y. Acad. Sci., vol. XXX, pp. 87-88, fig. 17.

<sup>2</sup>Boulenger, G. A. 1889. Ann. & Mag. Nat. Hist., [6], vol. III, pp. 307-308.

<sup>3</sup>Werner, F. 1899. Verh. zool.-bot. Ges. Wien, vol. XLIX, pp. 470-484.

Venezuela, fifty from Colombia, and large series from Panama. Early in the investigation I discovered that two very distinct forms were included under the name *E. pustulosus*. Specimens from Panama are strikingly different from those from eastern Colombia. I was unable to locate the type specimen of *Paludicola pustulosa*, which came from western Colombia, but Cope's original description referred to the Panamanian type. Accordingly I named the eastern Colombian specimens *E. ruthveni*.<sup>4</sup> The new form is very close to *E. trinitatis*, but is sufficiently distinct to be recognized. It is true that Venezuelan specimens of *E. ruthveni* are harder to distinguish from *E. trinitatis* than are Colombian specimens, and individual specimens might be confused, but the examination of a series from both areas shows constant differences. Specimens of *E. ruthveni* from the region of Caracas in Venezuela are larger on the average than *E. trinitatis*, tend to be darker dorsally, have a more noticeable pectoral spot, show a more distinct vertebral stripe, which extends further forward, have fewer linear warts, and display a much greater variation in ventral markings, ranging from immaculate on the belly to a pattern of dark round spots, which greatly exceed those of *E. trinitatis* in size. If Lutz had only Venezuelan material for comparison with *E. trinitatis*, it is easy to understand why he referred this species to what was then *E. pustulosus*. Certainly no one would confuse *E. pustulosus*, as now defined, with *E. trinitatis*. To summarize: *E. pustulosus* ranges from Mexico south to western Colombia and overlaps the range of *E. ruthveni* for an unknown distance in eastern Colombia; *E. ruthveni* ranges from eastern Colombia through Venezuela; and *E. trinitatis* is restricted to Trinidad and Tobago.

At this time it might be well to call attention to certain inaccuracies in the original description of *E. trinitatis*. Boulenger<sup>5</sup> states "male with a large external vocal sac on each side of the throat and brown rugosities on the inner side of the inner finger." It is easy to understand the misconception as to the vocal sac for I have seen two much-shrivelled males in which the skin composing the sac is gathered in folds only on the sides and is quite smooth in the middle.

Two different color phases occur in this species, among the males at least. Werner's description of *Bufo atrigularis* seems to be based

<sup>4</sup>Netting, M. Graham. 1930. Ann. Carn. Mus., vol. XIX, No. 3, pp. 167-168. Pl. VII.

<sup>5</sup>Boulenger, G. A., 1889, Ann. & Mag. Nat. Hist., [6] vol. III, p. 308.

upon the common or uniformly-marked phase. Preserved specimens of this phase are generally uniform light gray dorsally but may be uniform dark gray or brown. Boulenger's description of *E. trinitatis* refers to the rarer, brightly-marked phase, which shows contrasted dorsal markings even in alcoholic specimens. Twenty-six of twenty-eight males, which I examined, belong to the uniformly-marked phase, and five females are similar except that the entire region of the throat is red-brown and the median ventral stripe is more distinct than in the males. The following color description is taken from living specimens of the two phases.

*Uniform phase:* Uniform olive or brown above; a cream-colored line less than 5 mm. long extending forward from the region of the ischial symphysis sometimes present; parotoid and dorso-lateral glands lighter in color than the back; limbs with dark brown or blackish cross bars; plantar surfaces and lower surfaces of hind legs purplish; chin region gray or brown; anterior half of vocal sac black, and posterior half olive or lighter; belly white or cream with many small brown spots which increase anteriorly to form a more or less solid color over the breast; general appearance of ventral surface gray or brown; median line of white or cream distinct anteriorly, indistinct over the vocal sac, distinct on the breast, and lost in the light color of the belly; upper lip with two or three dark bars; a faintly outlined diamond sometimes visible behind the head; and a dark blotch on each side of the back posteriorly.

*Contrasted phase:* Two broad, cream-colored dorso-lateral stripes join anteriorly and cover the head and neck; central portion of the back behind and between these stripes brown; ground-color of upper surfaces of the hind legs orange; elbow and dorso-lateral glands very light-colored, and with a trace of orange; vertebral stripe narrow, but extending further forward, sometimes complete.

The sexes are markedly different in size. Twenty-eight males averaged 27.8 mm. in length, while five females averaged 31.9 mm.

This toad has been taken in Trinidad in St. George County at Port-of-Spain, St. Augustine, Mount St. Benedict, and Arima; in Mayaro County at Guayaguayare, which is at the extreme southeastern corner of the island; and in Tobago at Milford Bay. It is surprisingly rare in collections, and is apparently secured only when it comes to the water to breed.

Since there are no published notes upon the habitat of this species some mention should be made of the marked preference for muddy or foul water which it exhibits. The few cases in which individuals were taken in clear water may be disregarded, for in every instance the

toads had fallen into concrete basins from which they could not escape to more suitable breeding spots. I collected specimens in foul sewers, in roadside drainage ditches, in ditches of muddy water about construction projects, and in kitchen and laundry drains which were full of soapy water. In many cases the walls of the ditches were so steep that the subsequent escape of adults and young appeared impossible. I never found individuals in a natural pool or stream, although frequently such habitats were separated by only a few feet from the artificial pools which were in use. At one place a large roadside gutter emptied into a good-sized stream of clear water. *Eupemphix* bred in the gutter, but did not occur along the stream. Apparently the factor of current is of small moment, for I found egg-masses both in quiet water and in places where there was considerable current. I believe that this is a good example of an amphibian which has adopted a man-made habitat much as the Chimney Swift and Nighthawk have done. Probably this toad bred originally in quiet, leaf-cluttered pools of stagnant water, in hoof-prints along game trails, and in any temporary pools which were foul or muddy. *Eupemphix ruthveni* and *E. pustulosus* are known to breed in forest pools at the present time, but I am sure that a careful study of these species will indicate that *Eupemphix* chooses the leaf-filled pools rather than the clear pools which are chosen by such forms as *Hyla rosenbergi*. Females of *Eupemphix* are always hard to obtain, because they dive at the first sign of danger and remain hidden in the muddy water, or under debris in the pool.

The breeding season of *E. trinitatis* probably coincides with the duration of the rainy season. During 1927 breeding activities were in full swing throughout September, and in 1930 I collected calling males as late as February 15th, although I saw no egg-masses. The following observations upon life-history were entirely made during 1927, since my more recent visits to Trinidad were too brief to allow further work of this type.

At a distance of several hundred yards the call sounded much like the bark of a small dog. At close quarters it sounded like "ow-w-w-w-ác." The Trinidad bushmen, who apparently know this toad only by its voice, call it the "coong-la," presumably for onomatopoeic reasons. I heard full choruses only at night, although the toads sometimes called during the afternoon. When calling the males faced the bank, rested their forelegs upon it, and floated in the water with

only the forepart of their bodies above the surface. If the flashlight was focused directly upon an individual, it remained in place and sometimes continued calling, but if the light merely brushed a specimen it would dive and either swim to the opposite bank or come up in the middle and float.

I heard *trinitatis* on September 2nd, my first evening in the field. The rains had begun at this time, and many pools of ground water were in evidence. In a steep-sided ditch twenty-five feet in length and three feet wide I collected ten males, and failed to secure about as many more. No egg-masses were present at this time. I was unable to visit the same ditch again until September 13th, when I found eight egg-masses in the ditch. Six of these were two or three days old, and the remaining two had been laid the previous night. The same day I found a fresh egg-mass in a small gutter containing only three inches of water. On the 16th and 19th I found fresh masses at other places.

Every egg-mass which I saw was attached to a shale or clay bank. In several cases growing plants were stuck to the mass, but the evidence indicated that this was purely accidental. When laid the masses floated on the water, but in some cases the water level dropped several inches in following days and the masses were left suspended above the water. I do not know whether tadpoles which hatch in such masses wait for a rain to wash them out of the froth or not. Certainly those which hatched in the laboratory entered the water as soon as they could work their way through the froth.

At 11 p. m. on September 16th I took a clasping pair which I placed in a small jar in the laboratory. By seven o'clock the next morning all of the eggs had been laid and most of them beaten into the froth. The entire jar was filled with froth, so I judge that the crowded quarters had prevented the toads from beating all of the mass. The eggs are laid in a clear, sticky jelly. One or both of the parents then beat the jelly into foamlike froth. The bubbles of the froth are quite small and the entire mass is the size of a baseball. The eggs are light-colored, but faintly greenish in cast, so that they can be distinguished from the pure white froth. Ten fresh eggs averaged 1.5 mm. in diameter. Of two masses, which I kept, one produced four hundred and fifty-two and the other three hundred and three tadpoles.

Oviposition occurs late at night. From thirty-six to forty-eight hours later tadpoles can be observed moving in the egg-mass. From fifty to sixty hours after the eggs have been laid tadpoles enter the

water. Those from eggs which are close to the water work their way through the froth first, and those which come from eggs in the upper portion of the mass may not reach the water until as much as twenty-four hours later.

Newly hatched tadpoles, measured after preservation, have a total length of about 7 mm. and a body length of about 2 mm. These tadpoles feed readily upon bread crumbs. Tadpoles a week old measure from 10-12 mm. in length and have a body length of 4-5 mm. My observations were unfortunately terminated at this time so I cannot say when metamorphosis occurs.

In conclusion then: *Eupemphix trinitatis* is a valid form, which differs from the recently described mainland form, *E. ruthveni*. It lays from three hundred to four hundred and fifty eggs in a frothy mass in small pools of muddy or foul water. The masses are attached to the banks of the breeding pools, and the tadpoles enter the water about three days after egg-laying.